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EFFICIENCY OF PHYSICAL REHABILITATION OF PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Abstract

The analysis of the effectiveness of physical rehabilitation of patients with chronic obstructive pulmonary disease is carried out. Chronic obstructive pulmonary disease remains one of the most important health problems. In medical, social and economic terms, it is one of the main causes of morbidity and mortality worldwide; people suffer from this disease for years and prematurely die of it or its complications. Chronic obstructive pulmonary disease has a significant negative impact on quality of life, imposing restraints on working capacity, normal physical activity, home occupations, social and family activities, and sleep patterns. The purpose of the research is to study the effectiveness of the proposed method of physical rehabilitation of patients with chronic obstructive pulmonary disease. A comparative analysis of the data of a survey of 162 patients with chronic obstructive pulmonary disease of moderate severity in the process of treatment and physical rehabilitation was conducted. Patients in control groups underwent treatment according to the protocol and rehabilitation according to the generally accepted method, and patients in treatment groups underwent treatment according to the protocol and rehabilitation according to the proposed method. The effectiveness of rehabilitation was assessed by determining changes in the function of external respiration and quality of life parameters during the study. The use of physical rehabilitation in patients with chronic obstructive pulmonary disease has led to an increase in functional capabilities of patients, which was shown by an increase in the mean values of the parameters of external respiration in the study group at the end of the study, which indicate its effectiveness. By virtue of application of the proposed program of physical rehabilitation, it became possible to achieve a significant increase in the overall quality of life and health in patients of the main group by increasing parameters in problem areas and sub-sectors. Physical rehabilitation should be recommended to patients with chronic obstructive pulmonary disease to help control symptoms, improve quality of life and increase physical activity.

Key words: patients, chronic obstructive pulmonary disease, physical rehabilitation, function of external respiration, quality of life.

Микола Майструк. Ефективність проведення фізичної реабілітації хворих на хронічне обструктивне захворювання легень. Проведено аналіз ефективності фізичної реабілітації хворих на хронічне обструктивне захворювання легень. Хронічне обструктивне захворювання легень залишається однією з найважливіших проблем охорони здоров'я. У медико-соціальному та економічному плані воно є однією з основних причин захворюваності та смертності в усьому світі; люди страждають від цього захворювання роками й тому передчасно вмирають унаслідок або від її ускладнень. Хронічне обструктивне захворювання легень має суттєвий негативний вплив на якість життя, уключаючи накладання обмежень на працездатність, нормальне фізичне навантаження, домашні заняття, соціальні та сімейні заходи, а також режими сну. ***Мета дослідження*** – вивчити ефективність запропонованої методики фізичної реабілітації хворих на хронічне обструктивне захворювання легень. Проведено порівняльний аналіз даних обстеження 162 хворих на хронічне обструктивне захворювання легень помірного ступеня тяжкості в процесі лікування та фізичної реабілітації. Хворі контрольних груп проходили лікування згідно з протоколом та реабілітацію за загальноприйнятою методикою, а хворі основних груп – лікування згідно з протоколом та реабілітацію за запропонованою методикою. Ефективність реабілітації оцінювали за допомогою визначення змін функції зовнішнього дихання й показників якості життя впродовж дослідження. Застосування фізичної реабілітації у хворих на хронічне обструктивне захворювання легень призвело до нарощування функціональних можливостей хворих, що виразилося збільшенням середніх значень показників функції зовнішнього

дихання в досліджуваних основної групи наприкінці дослідження, які засвідчують її ефективність. Завдяки застосуванню запропонованої програми фізичної реабілітації для кожного хворого на хронічне обструктивне захворювання легень удалося досягнути достовірного підвищення загальної якості життя й стану здоров'я у хворих основної групи за рахунок збільшення показників у проблемних сферах і субсферах. Фізичну реабілітацію потрібно рекомендувати хворим на ХОЗЛ, щоб допомогти контролювати симптоми, поліпшити якість життя та збільшити фізичну активність.

Ключові слова: хворі, хронічне обструктивне захворювання легень, фізична реабілітація, функція зовнішнього дихання, якість життя.

Николай Майструк. Эффективность физической реабилитации больных хронической обструктивной болезнью легких. Проведен анализ эффективности физической реабилитации больных хронической обструктивной болезнью легких. Хроническая обструктивная болезнь легких остается одной из важнейших проблем здравоохранения. В медико-социальном и экономическом плане она является одной из основных причин заболеваемости и смертности во всем мире; люди страдают от этого заболевания годами и преждевременно умирают от него или от его осложнений. Хроническая обструктивная болезнь легких оказывает существенное негативное влияние на качество жизни, включая наложение ограничений на работоспособность, нормальную физическую нагрузку, домашние занятия, социальные и семейные мероприятия, а также режимы сна. ***Цель исследования*** – изучить эффективность предложенной методики физической реабилитации больных хронической обструктивной болезнью легких. Проведен сравнительный анализ данных обследования 162 больных хронической обструктивной болезнью легких средней степени тяжести в процессе лечения и физической реабилитации. Больные контрольных групп проходили лечение по протоколу и реабилитацию по общепринятой методике, а больные основных групп – лечение согласно протоколу и реабилитацию по предложенной методике. Эффективность реабилитации оценивали с помощью определения изменений функции внешнего дыхания и показателей качества жизни на протяжении исследования. Применение физической реабилитации у больных хронической обструктивной болезнью легких привело к наращиванию функциональных возможностей больных, выразившееся увеличением средних значений показателей функции внешнего дыхания у исследуемых основной группы в конце исследования, подтверждающие ее эффективность. Благодаря применению предложенной программы физической реабилитации, для каждого больного хронической обструктивной болезнью легких удалось достичь достоверного повышения общего качества жизни и состояния здоровья у больных основной группы за счет увеличения показателей в проблемных сферах и субсферах. Физическую реабилитацию следует рекомендовать больным хронической обструктивной болезнью легких, чтобы помочь контролировать симптомы, улучшить качество жизни и увеличить физическую активность.

Ключевые слова: больные, хроническая обструктивная болезнь легких, физическая реабилитация, функция внешнего дыхания, качество жизни.

Introduction. The respiratory system disease is one of the most common pathologies of the internal organs, which is characterized by a tendency to intensification. The most notable of these pathologies is chronic obstructive pulmonary disease (COPD), that remains one of the biggest health care problems nowadays. In medical, social and economic terms, it is one of the main causes of morbidity and mortality worldwide; people suffer from this disease for years and prematurely die of it or its complications. There is a rapid increase in COPD all over the world due to the long-term effect of risk factors and aging of population. The proportion of COPD as one of the leading causes of death is constantly increasing. COPD affects from 8 to 22◦% of adults aged 40 years or more [2; 5; 9; 12].

It is estimated that in the European Union, the total direct expenses on respiratory system diseases accounts for about 6 % of the total health care budget, while the expenses on COPD treatment amounts to 56 % of these expenses (€38,6 billion). In the USA, direct expenses on COPD treatment accounted for $29.5 billion, while indirect expenses were $ 20,4 billion. The greatest economic damage comes from the treatment of exacerbations of COPD. It is not surprising that there is a distinct direct correlation between the severity of COPD and the expenditures on its treatment, and as the disease progresses, a redistribution of costs occurs [6; 7; 10; 13].

COPD has a significant negative impact on quality of life, imposing restraints on working capacity, normal physical activity, home occupations, social and family activities, and sleep patterns. In addition to these problems, there is obviously a large amount of suffering associated with hospitalizations caused by exacerbations [1; 8; 11; 14; 15].

Despite the growing therapeutic and rehabilitation capabilities of modern medical ways and methods of treatment, the problem of medical rehabilitation of patients with COPD does not lose its relevance, so there is a need to search for new methods to improve their effectiveness.

The Purpose of the Research is to study the effectiveness of the proposed method of physical rehabilitation of patients with chronic obstructive pulmonary disease.

The Material and Methods of the Research. The research was conducted on the basis of pulmonology department of Rivne Regional Clinical Hospital. Accumulation of the results was carried out as patients were

hospitalized. Patients (COPD, II stage, moderate severity) were randomized to control (CG 2 – consisted of females (n = 40) and males (n = 44)) and treatment (TG 2 – consisted of females (n = 38) and the males (n = 40)) groups in accordance with the principles of bioethics. All patients were examined at the beginning and at the end of the research and were under the supervision of doctors. The COPD stage and the degree of respiratory failure were determined in accordance with clinical changes in patients, functional condition and spirographic data. Quality of life was defined with the help of the questionnaire WHOQOL-100, designed to assess the quality of life of the adult population of Ukraine. Patients of the control groups received the protocol treatment and rehabilitation according to the standard method, and patients of the treatment groups received the protocol treatment and rehabilitation according to the proposed method [3].

Research Results. Having analyzed the average variables of the ERF indices of patients with COPD of both groups at the beginning of the research, it was found out that they were below normal and did not differ significantly, which indicated a poor functional ability of the lungs and bronchial permeability. The findings indicate unsatisfactory functional state of patients' health and require appropriate treatment and early rehabilitation measures.

The effectiveness of treatment and physical rehabilitation was determined according to a number of parameters, the most important of which were fluctuations in the volume of forced expiration in the first second (FEV_1), forced vital capacity (FVC), which are traditionally considered the best parameters for assessing the degree of airflow obstruction. To determine the recurrency of airway obstruction (RAO), a bronchodilator test with β_2 short-acting agonists was performed according to the bronchial reactivity indices. ERF researches are the most informative parameters for assessing the severity of airflow obstruction, the severity and progression of COPD, the effectiveness of treatment and physical rehabilitation.

The results of physical rehabilitation on the background of the standard treatment for all the patients were examined in dynamics, which allowed us to objectively establish the effectiveness of the traditional and the proposed rehabilitation measures. Positive dynamics were previously observed in TG 2 patients: the decrease of dyspnea, the improvement of expectoration, disappearance of pulmonary rale, improvement of sleep and general state. It is particularly important that the disease has become controlled which is confirmed by a statistically significant increase in average ERF parameters in comparison.

At the beginning of the study the average FEV_1 in female CG 2 patients with COPD was 69,11 ± 0,50 %, TG 2 was 69,04 ± 0,23 %; at the end of the study, respectively, 70,84 ± 0,47 % and 81,68 ± 0,51 % ($p < 0,05$). Average FEV_1 at the end of the study in female TG 2 patients with COPD, who followed developed concept of physical rehabilitation, exceeded those in CG 2 patients.

Average parameters of FEV_1 at the beginning of the study in male CG 2 patients with COPD were 67,11 ± 0,38 %, TG 2 69,81 ± 0,48 %; and at the end of the study, respectively, 68,03 ± 0,36 % and 81,00 ± 0,48 % ($p < 0,05$). The use of physical rehabilitation led to the developing of the functional capacity of patients, resulting in an increase in the average FEV_1 in male TG 2 patients with COPD, which exceed those in CG 2 patients.

Analyzing VC of lungs, it was found out that at the beginning of the study it was in female CG 2 patients – 73.47 ± 0,42 %, in the TG 2 – 73,34 ± 0,35 %; at the end of the study, 75,02 ± 0,43 % and 83,23 ± 0,12 % ($p < 0,05$), respectively.

Average parameters of LCV at the beginning of the study in male CG 2 patients with COPD were 73,05±0,32 %, in TG 2 – 74,47±0,47 %; and at the end of the study, 73,31±0,27 and 86,30±0,70 % ($p < 0,05$), respectively. We can observe a significant increase in the lung capacity ratio in the female and male TG 2 patients at the end of the study.

At the beginning of the study the average RAO in female CG 2 patients with COPD was 22,07±0,10 %, TG 2 was 23,27±0,01 %; at the end of the study, respectively, 13,38±0,10 % ($p<0,05$) and 9,48±0,01 % ($p < 0,05$). Average RAO of TG patients with COPD, who followed the developed concept of physical rehabilitation exceeded those in patients with CG 2.

At the beginning of the study the average RAO in male CG 2 patients with COPD was 23,47±0,10%, TG 2 - 3,40±0,10%; at the end of the study, respectively, 10,91±0,06% ($p<0,05$) and 10,64±0,10% ($p<0,05$) Average RAO of TG 2 patients with COPD, who followed the developed concept of physical rehabilitation exceeded those in patients with CG 2.

Therefore, we can state that significant changes in bronchial reactivity parameters in female and male TG 2 patients with COPD, which statistically significantly decreased after the implementation of physical rehabilitation programs ($p <0.05$), which did not happen in the control group.

Discussion Analyzing the average values of the ERF parameters in patients with COPD of both groups, we see that these parameters were below the standard at the beginning of the study, did not differ significantly

from each other. At the end of the study they increased in TG 2 patients (approached the proper ones), which indicates an improvement in small bronchial permeability, which is especially important for patients. We can clearly see a slight increase in the average values of FEV_1 (by 1,73 %), VC of lungs (by 1,55 %) and sufficient RAO (by 8,69 %) in female CG 2 patients; and in male CG 2 patients: a slight increase in FEV_1 (by 0,92 %), VC of lungs (by 0,26 %) and sufficient RAO (by 12,56 %) at the end of the study. At the same time, in TG 2 patients, the stable positive dynamics can be traced: a significant ($p < 0,05$) major increase in the average parameters of FEV_1 (by 12.64%), VC of lungs (by 9,89 %), RAO (13,79 %) in female patients and FEV_1 (11,19 %), VC of lungs (11,83 %) and RAO (12,76 %) in male patients at the end of the study. The implementation of physical rehabilitation has led to a rise in the patients' functional capabilities, which was shown by the ERF average increase in the analyzed TG 2 at the end of the research. Improvement of the functional state of the respiratory system in the analyzed TG 2 indicates the positive effect of physical rehabilitation classes according to the elaborated technique on the motor abilities of patients with COPD. In general, it can be noted that treatment and physical rehabilitation of all TG 2 patients have led to the ERF normalization.

To define the effectiveness of physical rehabilitation according to the quality of life international standards, we used the Ukrainian version of quality of life questionnaire of the World Health Organization (WHOQOL-100), designed to assess the quality of life of the adult population of Ukraine [4].

Using the quality of life assessment methodology, we defined the quality of life of each patient at the output level at the end of the research, in order to monitor the changes and evaluate the effectiveness of the measures taken.

A low average output level of overall quality of life and health was indicated within the patients with COPD of both male and female groups.

Thus, in CG 2 it reached 48,13 ± 0,61 points in male patients. In particular research spheres, the parameters were as follows: sphere I (physical sphere), 6,51 ± 0,11, sphere II (psychological sphere) – 9,25 ± 0,11, sphere III (level of independence) – 5,98 ± 0, 09, sphere IV (social relations) – 7,83 ± 0,14, sphere V (the environment) – 7,93 ± 0,08, sphere VI (spiritual sphere) – 10,64 ± 0,35.

The same low average output level of the general quality of life and health – 49,28 ± 0,55 – was observed in male patients of TG 2. In particular spheres of study, it comprised: sphere I (physical sphere) – 6,77 ± 0, 11, sphere II (psychological sphere) – 9,34 ± 0,12, sphere III (level of independence) – 5,98 ± 0,09, sphere IV (social relations) – 8,05 ± 0,11, sphere V (environment) – 7,98 ± 0.08, sphere II (spiritual sphere) – 11,18 ± 0,33. As we see, the decrease in the quality of life was due to the impact of the disease on all the subspheres of patients' life.

At the beginning of the research, the same low average output level of overall quality of life and health was noticed in female patients of both groups. In patients of CG 2 it was 47,77 ± 0,51 points and 49,39 ± 0,51 points in female patients of TG 2. Parameters of definite spheres in patients of CG 2 were as follows: sphere I (physical sphere) – 6,46 ± 0,10, sphere II (psychological sphere) – 9,03 ± 0,90, sphere III (level of independence) – 6,01 ± 0,10, sphere IV (social relations) – 8,01 ± 0,13, sphere V (environment) – 7,92 ± 0,08, sphere VI (spiritual sphere) – 10,35 ± 0,27.

In the particluar research spheres, the output level of overall quality of life and health of TG 2 patients was: sphere I (physical sphere) – 6,69 ± 0, 09, sphere II (psychological sphere) – 9,24 ± 0,11, sphere III (level of independence) – 6,01 ± 0,11, sphere IV (social relations) – 8,11 ± 0,12, sphere V (environment) – 7,99 ± 0,08, sphere VI (spiritual sphere) – 11,34 ± 0,29. The decrease in the overall quality of patients' life was due to the negative impact of the disease on all the subspheres of human life.

At the end of the research the average level of overall quality of life and health in male patients of CG 2 changed slightly to 48,42 ± 0,58 points. In certain spheres, the parameters were close to the output ones, with a slight improvement: sphere I (physical sphere) – 6,57 ± 0,12, sphere II (psychological sphere) – 9,30 ± 0,09, sphere III (level of independence) – 6,10 ± 0,08, sphere IV (social relations) – 7,87 ± 0.12, sphere V (environment) – 7,94 ± 0,08, sphere VI (spiritual sphere) – 10,64 ± 0,35 points – at the same level.

As for the male patients of TG 2, their average level of general quality of life and health significantly increased to 56,14 ± 0,38 points ($p < 0,05$) at the end of the research. In certain spheres of study, the parameters became significantly higher than output ones and reached: sphere I (physical sphere) – 9,25 ± 0,07 ($p < 0,05$), sphere II (psychological sphere) – 9,91 ± 0,09 ($p < 0.05$), sphere III (level of independence) – 7,70 ± 0,06 ($p < 0.05$), sphere IV (social relations) – 9,24 ± 0,10 ($p < 0.05$), sphere V (environment) – 8,46 ± 0,07 ($p < 0,05$), sphere VI (spiritual sphere) – 11,58 ± 0,29 points. So, a significant increase in the overall quality of life and health in TG 2 patients was observed in all spheres and subspheres of quality of life, except spiritual one.

At the end of the study the average overall quality of life and health in female patients of CG 2 became slightly higher and counted 48,06 ± 0,45 points. Particular parameters of the research spheres were: sphere I (physical sphere) – 6,58 ± 0,09, sphere II (psychological sphere) – 9,04 ± 0,08, sphere III (level of independence) – 6,07 ± 0,09, sphere IV (social relations) – 8,08 ± 0,11, sphere V (environment) – 7,94 ± 0,07, sphere VI (spiritual sphere) – 10,35 ± 0,27 points.

Over the scope of the spheres, the level of overall quality of life and health of female patients of TG 2 significantly increased: sphere I (physical sphere) – 9,82 ± 0,07 ($p < 0,05$), sphere II (psychological sphere) – 10,53 ± 0,09 ($p < 0,05$), sphere III (level of independence) – 8,15 ± 0,09 ($p < 0,05$), sphere IV (social relations) – 9,20 ± 0, 10 ($p < 0,05$), sphere V (environment) – 8,52 ± 0,08 ($p < 0,05$), the sphere VI (spiritual sphere) – 11,74 ± 0,21 points – insignificantly. The average level of overall quality of life and health increased to 57,96 ± 0,28 ($p < 0,05$) points. A definite increase in the overall quality of life and health of TG patients took place in all spheres and subspheres, with an exception of the spiritual one.

Discussion. From all mentioned above, it is obvious that at the beginning of the research the level of general quality of life both in male and female patients of both groups was approximately the same. Analyzing the results of questionnaire survey of patients with COPD as to the overall quality of life and health at the beginning of the research, we see, in comprasion with the average data of healthy population, that in CG 2 and TG 2 patients almost all parameters of spheres and subspheres of quality of life are reduced, which requires an appropriate rehabilitation. The obtained data prove the necessity of the individualized physical rehabilitation implementation, taking into account motor abilities, in complex with social and psychological rehabilitation of this category of patients.

After the implementation of the proposed physical rehabilitation program for each patient with COPD, we observed an increase in overall quality of life and health of TG 2 patients due to the increasing rates in problematic subspheres. Patients of TG have pointed out discomfort diminishment, increase in vitality and energy, positive feelings, improvement of sleep pattern, thinking, self-esteem, negative emotions reduction, enhancement of mobility, efficiency, ability to perform daily routine, sexual activity, betterment of personal relationships, use of transport. Only parameters of the spiritual sphere increased slightly. Significant changes in quality of life and health have not been noted in patients of CG.

Conclusions. Physical rehabilitation plays an important role in the complex treatment of patients with COPD. Implementation of physical rehabilitation allows to achieve the positive changes that can not be achieved only with the help of medical therapy. In particular, in patients of the treatment group, this led to an increase in patients' functional capabilities, which was shown by an increase in the average parameters of an external respiration function at the end of the research, that proves its effectiveness. Improvement of the functional state of the respiratory system in the treatment group patients indicates the positive effect of physical rehabilitation practice according to the elaborated technique on motor abilities of patients with COPD. Due to the implementation of the proposed physical rehabilitation program, it was possible to achieve a significant increase in the overall quality of life and health of patients in the treatment group by increasing parameters in problematic spheres and subspheres. Physical rehabilitation should be recommended to patients with COPD to help control symptoms, improve quality of life and increase physical activity.

Further research is needed to verify practical realization of the main issues of physical rehabilitation of patients with COPD construct.

Sources and Literature

1. Григус І., Майструк М. Зміни функціонального стану хворих на хронічне обструктивне захворювання легень у процесі фізичної реабілітації. *Вісник Прикарпатського університету. Серія: Фізична культура*, 2017. Вип. 25–26. С. 83–91.
2. Григус І. М. Фізична реабілітація в пульмонології: навч. посіб. – Рівне: НУВГП, 2015. 258 с.
3. Майструк М. І. Методичні аспекти проведення фізичної реабілітації хворих на хронічне обструктивне захворювання легень. *Фізичне виховання, спорт і культура здоров'я у сучасному суспільстві.* 2015. № 3 (31). С. 216–220.
4. Методика оцінки якості життя / Всесвітня організація охорони здоров'я: Українська версія: [рек. по використанню]/за наук. ред. д-ра мед. наук С. В. Пхіденка. Дніпропетровськ: Пороги, 2001. 58 с.
5. Criner G. J., J. Bourbeau, R. L. Diekemper, D. R. Ouellette, D. Goodridge, P. Hernandez [et al.] (2015) Prevention of acute exacerbations of COPD: American College of Chest Physicians and Canadian Thoracic Society Guideline. *Chest.* Apr 147(4). P. 894

6. Emma E. Vincent, Emma J. Chaplin, Johanna E. A. Williams, Theresa Harvey-Dunstan, Neil J. Greening, Michael C. Steiner, Mike D. Morgan and Sally J. Singh. (2017) Experiences of patients undergoing pulmonary rehabilitation during an exacerbation of chronic respiratory disease. *Chronic Respiratory Disease.* Vol. 14(3). P. 298–308.
7. Grygus I., Maistruk M. (2013) Obecny stan przewlekłej obturacyjnej choroby płuc. *Journal of Health Sciences*. 3(10). S. 729–744.
8. Gulart AA, Santos K, Munari AB. (2015) Relationship between the functional capacity and perception of limitation on activities of daily life of patients with COPD. *Fisioter Pesq.* 22(2). S. 104–111.
9. Hakamy Ali, Charlotte E Bolton and Tricia M McKeever. (2017) The effect of pulmonary rehabilitation on mortality, balance, and risk of fall in stable patients with chronic obstructive pulmonary disease: A systematic review. *Chronic Respiratory Disease.* Vol. 14(1). S. 54–62.
10. Jibril Mohammed, Hellen Da Silva, Jessica Van Oosterwijck and Patrick Calders. (2017) Effect of respiratory rehabilitation techniques on the autonomic function in patients with chronic obstructive pulmonary disease: A systematic review. *Chronic Respiratory Disease*. Vol. 14(3). S. 217–230.
11. Kim J. K., J. K. Kim, C. M. Lee, J. Y. Park et al. (2016) Active case finding strategy for chronic obstructive pulmonary disease with handheld spirometry. *Medicine* (Baltimore). Dec. 95(50).e5683.
12. Lee SD, Huang MS, Kang J. (2014) The COPD assessment test (CAT) assists prediction of COPD exacerbations in high-risk patients. *Respir Med*. 108(4). S. 600–608.
13. Represas-Represas C., A. Fernandez-Villar, A. Ruano-Ravina et al. (2016) Screening for chronic obstructive pulmonary disease: validity and reliability of a portable device in non-specialized healthcare settings. *PLoS One* 2016. 11:e0145571.
14. Rodriguez D. A., Arbillaga A., Barberan-Garcia A et al. (2016) Effects of interval and continuous exercise training on autonomic cardiac function in COPD patients. *Clin Respir J*. 10(1). S. 83–89.
15. Zainuldin R., R. Zainuldin, M. G. Mackey, J. A. Alison (2012) Prescription of walking exercise intensity from the incremental shuttle walk test in people with chronic obstructive pulmonary disease. *Am J Phys Med Rehabil*. 91. S. 592–600.

References

1. Hryhus, I. & Maistruk, M. (2017). Zminy funktsionalnoho stanu khvorykh na khronichne obstruktyvne zakhvoriuvannia lehen u protsesi fizychnoi reabilitatsii [Changes in the functional status of patients with chronic obstructive pulmonary disease in the process of physical rehabilitation]. *Visnyk Prykarpatskoho universytetu, Fizychna kultura*, vyp. 25–26, 83–91.
2. Hryhus, I. M. (2015). Fizychna reabilitatsiia v pulmonolohii [Physical rehabilitation in pulmonology]. Rivne, NUVHP, 258.
3. Maistruk, M. I. (2015). Metodychni aspekty provedennia fizychnoi reabilitatsii khvorykh na khronichne obstruktyvne zakhvoriuvannia lehen [Methodological aspects of physical rehabilitation conducting of the ill with chronic obstructive pulmonary disease]. *Fizychne vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*, №3(31), 216–220.
4. Pkhidenko, S. V. (2001). Metodyka otsinky yakosti zhyttia / Vsesvitnia orhanizatsiia okhorony zdorovia: Ukrainska versiia [Methodology for quality of life assessment]. Dnipropetrovsk, Porohy, 58.
5. Criner, G. J., Bourbeau, J. Diekemper, R. L., Ouellette, D. R., Goodridge, D. & P. Hernandez, P. (2015). Prevention of acute exacerbations of COPD: American College of Chest Physicians and Canadian Thoracic Society Guideline. *Chest*., Apr 147(4), 894–2
6. Emma E Vincent, Emma J Chaplin, Johanna EA Williams, Theresa Harvey-Dunstan, Neil J Greening, Michael C Steiner, Mike D Morgan and Sally J Singh. (2017). Experiences of patients undergoing pulmonary rehabilitation during an exacerbation of chronic respiratory disease. *Chronic Respiratory Disease*, vol. 14(3) 298–308.
7. Grygus, I., Maistruk, M. (2013) Obecny stan przewlekłej obturacyjnej choroby płuc. *Journal of Health Sciences*, 3(10), 729–744.
8. Gulart, A. A, Santos, K, Munari, A. B. (2015). Relationship between the functional capacity and perception of limitation on activities of daily life of patients with COPD. *Fisioter Pesq.*, 22(2), 104–111.
9. Hakamy, Ali, Charlotte, E Bolton & Tricia, M McKeever (2017). The effect of pulmonary rehabilitation on mortality, balance, and risk of fall in stable patients with chronic obstructive pulmonary disease: A systematic review. *Chronic Respiratory Disease*, vol. 14(1), 54–62.
10. Jibril, Mohammed, Hellen, Da Silva, Jessica, Van Oosterwijck & Patrick, Calders (2017). Effect of respiratory rehabilitation techniques on the autonomic function in patients with chronic obstructive pulmonary disease: A systematic review. *Chronic Respiratory Disease*, vol. 14(3), 217–230.
11. Kim, J. K., Lee, C. M. Park, J. Y et al. (2016). Active case finding strategy for chronic obstructive pulmonary disease with handheld spirometry. *Medicine* (Baltimore), dec., 95(50), 5683.

12. Lee, S. D., Huang, M. S., Kang, J. (2014). The COPD assessment test (CAT) assists prediction of COPD exacerbations in high-risk patients. *Respir Med*., 108(4), 600–608.
13. Represas-Represas, C., Fernandez-Villar, A., Ruano-Ravina, A. et al. (2016). Screening for chronic obstructive pulmonary disease: validity and reliability of a portable device in non-specialized healthcare settings, *PLoS One*,11, 0145571.
14. Rodriguez, D. A., Arbillaga, A., Barberan-Garcia, A. et al. (2016). Effects of interval and continuous exercise training on autonomic cardiac function in COPD patients. *Clin Respir J*, 10(1), 83–89.
15. Zainuldin, R., Zainuldin, R., Mackey, M. G. &. Alison, J. A (2012). Prescription of walking exercise intensity from the incremental shuttle walk test in people with chronic obstructive pulmonary disease. *Am J Phys Med Rehabil*., 91, 592–600.

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